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INFORMATION FROM THE SOVIET BOOK "PROBLEMS OF SEA CORROSION"

/The following report consists of extracts from the book Problems of Sea Corrosion and includes prefatory remarks, the table of contents, and the full text of a resolution made by the Conference on Protection of Metals Against Corrosion in Sea Water on 20 November 1948./

PREFACE

In the second half of 1947, the Commission on the Protection of Metals Against Corrosion was organized in the Department of Chemical Sciences of the Academy of Sciences USSR. Functions of the commission were defined as follows: "The objective of the commission is to encourage the development of scientific research and practical work in the struggle against the corrosion of metals, promote the study of new problems and individual subjects contributing to the solution of theoretical and applied problems in the field of protection of metals against corrosion, and to propagate and popularize the newest achievements in the field of the theory and practice of anticorrosive protection of metals." This book represents a symposium of reports delivered at a conference arranged by the commission.

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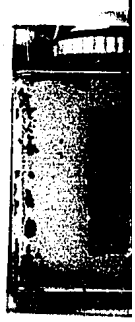
RESOLUTION OF CONFERENCE ON PROTECTION OF METALS AGAINST CORROSION IN SEA WATER

Upon hearing and discussing the reports on the corrosion of metals in sea water, the conference recognizes the great significance of the problem under consideration. Sea corrosion inflicts enormous damage on the hulls of ships and seaplanes, marine installations and instruments, maritime hydraulic structures, and the equipment of oil fields.

In spite of numerous research works and measures for protecting metals and alloys against corrosion, the maritime fleet of the USSR suffers considerable corrosion damage to vessels and stationary hydraulic structures.

For example, the service life of the outer plating on many ships amounts to 6-10 years, after which period the plating is completely replaced. Failure to dock vessels at any time during the entire period of their operation was, in many cases, one of the basic causes for the intensified corrosion of plating. Extensive damage is inflicted by the corrosion of steel propellers, the blades of which must be replaced after 2-3 years of service even though there is no mechanical deficiency. Premature wear of rivets and deterioration of the plating around rivets are registered. In connection with conversion of contemporary



shipbuilding from riveted to welded joints, a study of the corrosive behavior of welded construction becomes especially essential, since experience in the exploitation of such construction is very insignificant. Postwar restoration of the maritime fleet requires decisive action in the acceptance of anticorrosive measures.

The service life of metal and reinforced-concrete hydraulic structures operated under sea conditions is prohibitively short, reaching, at the lower end of the scale, 15-20 years for structures of ordinary steel and 10-15 years for structures of unprotected reinforced concrete. This is caused by the use of inappropriate materials and a lack of proper protective measures.

Oil fields in coastal areas suffer considerable losses from the corrosion of pumps, coolers, compressor parts, etc., as a result of using sea water without anticorrosive measures. The protection of submerged wells and trestles of oil fields against corrosion is an extremely imperative problem.

The premature deterioration of a number of vessels and hydraulic structures is explained, to a considerable extent, by faulty painting procedure because of which paint coatings readily lose their effectiveness. Painting technology disregards the latest achievements in the field of the theory and practice of corrosion, in the chemistry of high-molecular compounds, and in extensive operational experience.

Research work on the corrosion of metals and alloys is frequently conducted with a neglect of real conditions, disregarding local peculiarities and the shape of construction. Lack of a unified method for investigations, and an insufficient number of actual tests lead to a great diversity in general conclusions and in opinions on the possible potential service life of marine structures and vessels.

On the basis of the foregoing statements, the conference made the following proposals:

1. To regard as a necessity the establishment of a network of marine corrosion stations on the Black, Baltic, Barents, and Caspian seas, and on the Pacific Ocean.

To request that the Commission on Protection of Metals Against Corrosion appeal to the Academies of Sciences of the Ukraine, Latvia, Azerbaydzhan, and Georgia, suggesting their participation in creating corrosion stations with the following program of activities:

a. Systematic inspection of maritime hydraulic structures

b. Systematic inspection of seagoing vessels

c. Arrangement of experimental works on the study of the corrosive behavior of various materials and on the development of protective measures under natural conditions

d. Studying problems of incrustation of vessels and structures.

The activity of marine stations should proceed in close contact with the inspectorate of the Maritime Register of the USSR.

2. For improving the effectiveness of paint coatings, which are presently the basic protective measure against sea corrosion, it is recommended that the Maritime Register of the USSR supplement its "Regulations" with a requirement for obligatory removal of technological scale from the surface of steel plates,

pipes, and rivets designated for those parts of a ship which have contact with sea water. Surfaces must be sandblasted, etched, or cleaned with metal brushes. Painting is permissible only over a dried surface.

It is extremely necessary that mechanized methods for surface preparation of ship plating before painting be developed for use in the operations of the Ministry of the Maritime Fleet and Ministry of the Shipbuilding Industry. Launching of a ship before paint is entirely dry must be forbidden.

3. To recommend "NIVK" paints, developed by the TsNIIMSP (Central Scientific-Research Institute, Ministry of the Shipbuilding Industry), as the most effective protective coating and organize development of bituminous paints for surfaces subjected to alternate action of water and air and not exposed to the effect of alkali softening. Painting should not be done directly with sea-crust-inhibiting paints.

To request that the presidium of the Academy of Sciences USSR oblige the Institute of High-Molecular Compounds, Academy of Sciences USSR, to work out the subject "Theoretical Fundamentals of Selecting High-Molecular Compounds for Anticorrosive Coatings."

To consider as desirable the conducting of numerous practical tests of semimetal coatings on the basis of coal lacquer and metal powders, such as aluminum and zinc dust.

To ask the Bureau of Technical Standardization to revise the standard for coal lacquer, eliminating the paragraph which permits production of lacquer with acid properties.

To go before the Ministry of the Metallurgical Industry with a plea for a considerable increase in the production of aluminum powder and zinc dust, since these products, which show good results in the testing of paints in sea water, are extremely scarce.

4. To recommend, as protection against sea corrosion, thick zinc and aluminum coatings (75-150 microns), applied by metal spraying and, in the case of zinc, also by the hot galvanizing method.

5. To consider as necessary activities the further development and application of protective shielding, and new investigations on this subject in the Institute of Physical Chemistry of the Academy of Sciences USSR, in the Odessa Institute of Engineers of the Maritime Fleet, and in TsNIIMF (Central Scientific Research Institute of the Maritime Fleet).

To consider protective shielding as an expedient measure for protecting ship hulls, cisterns, hydraulic structures, marine installations, and submarine pipelines. Aluminum-base alloy with 5% of zinc is suggested as a material for this purpose.

6. Strict observation of normal periods for docking ships, and cleaning and painting them is necessary.

7. Since frequent damage to ships during their repair has been caused by stray currents due to poor insulation of wires feeding electric current from shore to ship, it is necessary:

a. To secure strict control over insulation

b. To forbid categorically the use of the single-wire system.

8. To consider the investigation of cathodic protection in application to real marine objects (determination of the radius of anode action, establishing the effect of conditions of a medium as a necessary activity.

To recommend cathodic protection as an additional method for protecting pipelines and hydraulic structures.

9. To consider expedient the use of low-alloy, high-strength steels under sea conditions, provided that parts made of these steels are protected against corrosion. These steels include the SKhL grade (0.12-0.22% C, 0.5-0.8% Mn, 0.3-0.5% Si, 0.3-0.5% Cu, 0.4-0.8% Cr, 0.3-0.7% Ni, 0.04% max P and 0.045 max S), made out of naturally alloyed pig iron.

10. To recommend a wider application of magnalium in shipbuilding and marine aviation, and the development of its experimental manufacture into mass production.

11. To consider it necessary for scientific organizations and design bureaus to study and develop structural members and units which will secure the greatest corrosion resistance.

Studies of riveted and welded joints under natural and laboratory conditions are essential because of the wide application of these methods of joining in shipbuilding.

12. To recommend to the Ministry of Heavy Machine Building the development of works of the TsKTI (Central Boiler-Turbine Institute) in the field of preventing corrosion of condenser pipes. These works are of great significance in the national economy, having the purpose of conserving nonferrous metals, and decreasing the shortage of the electric power supply for Baku oil fields and other industrial branches. Work on the investigation of corrosion of condenser pipes must be more extensively developed.

13. For increasing the corrosion fatigue limit of various parts in marine installations, wide testing under operational conditions must be arranged for protection methods suggested by the TsNIITMASh (Central Scientific-Research Institute of Technology and Machine Building), such as zinc plating, shielding, and surface electric hardening with subsequent galvanizing.

Further development of research works by TsNIITMASh in the field of protection against corrosion fatigue is extremely desirable.

14. To ask the Ministries of Maritime Fleet, Petroleum, and Fish Industries and the Ministry of Construction of Military and Naval Structures to organize constant observation over corrosion and incrustation of marine structures and vessels. For this purpose, a single system must be worked out for evaluating the effect of various factors. The ministry should be asked to supply the commission with data on corrosion conditions of the objects.

15. Instructions on the application of protectors and paints should be worked out by TsNII (Central Scientific Research Institute) imeni Krylov and TsNIIMF, and approved by the commission.

16. It is necessary to organize a course of 50-60 hours in metals corrosion, including the subjects covered in this book, for students of machine building, shipbuilding, petroleum, transportation, and power engineering higher technical schools.

17. The conference appreciates the exceptionally extensive and interesting work conducted by the Maritime Register of the USSR.

18. It is necessary to call a second conference on sea corrosion in 1951.

Conference Chairman: G. V. Akimov, Corr Mem Acad Sci USSR

Scientific Sec of the Conference: V. P. Batrakov, Cand Tech Sci

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